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10/675,435	09/30/2003	Naoya Hasegawa	9281-4659	5640

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Brinks Hofer Gilson & Lione
P.O. Box 10395
Chicago, IL 60610

EXAMINER	
BERNATZ, KEVIN M	

ART UNIT	PAPER NUMBER
1773	

DATE MAILED: 05/03/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/675,435	HASEGAWA ET AL.	
	Examiner	Art Unit	
	Kevin M Bernatz	1773	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-31 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-31 is/are rejected.

7)☒ Claim(s) 18 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 9/30/03; 3/19/04.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Preliminary amendments to the specification and claims 1, 2, 4, 8, 9, 12 – 14, 16, 18 – 20, 22, 24, 26, 28 and 29, filed on September 30, 2003, have been entered in the above-identified application.

Claim Objections

2. Claim 18 is objected to because of the following informalities: the nonmagnetic metal layer is claimed to be a "PtMn alloy" or a "X-Mn alloy", where Pt is included in X, hence repeating the "PtMn alloy". Applicants are suggested to either remove the recitation to a "PtMn-alloy" or to remove "Pt" from the list of elements included in X. Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 3 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 3 recites the limitation "the magnetization control layer comprises permanent-magnetic layers in direct contact with both side portions of the free magnetic

layer", yet claim 2 (of which claim 3 depends) requires that the magnetization control layer is "a second antiferromagnetic layer provided below the free magnetic layer ... so that the magnetization control layer is in contact with the bottoms of both side portions of the free magnetic layer". The magnetization control layer cannot be both an AFM layer *in contact with* the free magnetic layer and permanent magnetic layers *in contact with* the free magnetic layer. For purposes of evaluating the prior art, the Examiner has interpreted claim 3 as depending from claim 1, not claim 2.

Double Patenting

5. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

6. Claims 1 – 31 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 - 16 of copending Application No. 10/671,970 (Hasegawa et al. – U.S. Patent App. No. 2004/0067389 A1) in view of Hasegawa et al. (JP 2000-348309 A). See U.S. Patent

No. 6,700,756 B1 which is the English language equivalent of JP '309 A. This is a provisional obviousness-type double patenting rejection.

Regarding claim 1, Hasegawa et al. ('389 A1) disclose a magnetic detecting element comprising a multilayer film comprising a first antiferromagnetic (AFM) layer, a pinned magnetic layer, a nonmagnetic material layer and a free magnetic layer (*claim 1*), which are laminated in that order on a substrate (*ibid*), wherein the pinned magnetic layer comprises a first magnetic layer extending in a track width direction in contact with the first AFM layer, a second magnetic layer facing the first magnetic layer in a thickness direction, and a nonmagnetic intermediate layer interposed between the first and second magnetic layers, magnetization of the first and second magnetic layers being antiparallel to each other (*ibid*); the first AFM layer has a predetermined space in the track width direction so that the first AFM layer is in contact with both side portions of the first magnetic layer in the thickness direction (*ibid*); and an electric resistance in the space changes in relation to a magnetization direction of the free magnetic layer and a magnetization direction of the second magnetic layer (*ibid*).

Hasegawa et al. ('389 A1) fail to disclose a magnetization control layer for controlling magnetization of the free magnetic layer.

However, Hasegawa (JP '309) teaches using a magnetization control layer to control the magnetization of the free magnetic layer such that the free and pinned cross each other and to place the free magnetic layer into a single domain state (*col. 1, line 52 bridging col. 3, line 18*).

It would, therefore, have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Hasegawa et al. ('389 A1) to use a magnetization control layer meeting applicants' claimed limitations as taught by Hasegawa (JP '309) since such a layer can be used to control the magnetization of the free magnetic layer such that the free and pinned cross each other and to place the free magnetic layer into a single domain state.

Regarding claims 2, 3, 5 – 7, 9 – 11 and 13, the "order" of the layers on the substrate are known equivalent sensor structures, typically described as "bottom-type" and "top-type" (*JP '309 A – columns 17 – 18*). Furthermore, Hasegawa (JP '309 A) teach that using permanent magnetic layers meeting applicants' claimed structural limitations and AFM layers meeting applicants' claimed structural limitations are both known means for providing bias to a free magnetic layer (*Figure 12, element 29 and Figure 13, element 26*). Regarding the language in claim 10, the Examiner notes that simply by the fact that the first AFM layer has a gap in the track width direction, the "substrate" upon which it is deposited will also clearly possess recessed portions where the 1st AFM layer is deposited (the Examiner notes that the claims do not limit the "substrate" to being only one layer or all the same material).

Regarding claims 4, 8, 12 and 14, the Examiner deems that the relative dimensions between the 1st AFM in the track width direction and the minimum distance of the free magnetic layer (i.e. the distance between the biasing elements, which determines the track width of the head) is a results effective variable which effects the track width of the overall magnetic sensor. The Examiner deems that it would have

been obvious to one having ordinary skill in the art to have determined the optimum value of a results effective variable such as the relative dimensions between the two layers through routine experimentation, especially given the knowledge that both would influence the properties of the spin valve and the track width of the spin valve. I.e. the Examiner deems it would have been obvious to make them the same gap distance since such a distance would function as the track width and would be deemed to have uniform properties within the track width. *In re Boesch*, 205 USPQ 215 (CCPA 1980); *In re Geisler*, 116 F. 3d 1465, 43 USPQ2d 1362, 1365 (Fed. Cir. 1997); *In re Aller*, 220 F.2d, 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Regarding claim 15, the Examiner notes that it is known in the art that the smaller the track width, the smaller the domain size a MR sensor can read/write to. Hence, the Examiner deems it would have been obvious to optimize the track width to within applicants' claimed range since such a range would allow increased read/write density.

Regarding claims 16 and 31, Hasegawa (JP '309) discloses electrode layers meeting applicants' claimed structural, material and functional limitations, i.e. "CiP-type sensors" (*col. 2, lines 14 – 15 and col. 40, line 42 bridging col. 41, line 8*). The Examiner notes that "CiP-type" and "CPP-type" sensors are known equivalent sensors with the main functional difference simply being the location of the electrode layers to control whether the current flows in-plane (CiP) or perpendicular to the plane (CPP). The rest of the structure of the sensors are substantially identical.

Regarding claims 17 – 30, Hasegawa et al. ('389 A1) disclose identical limitations (*claims 2 – 14*).

7. Claims 1 - 31 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 3, 17 and 26 - 38 of copending Application No. 10/823,484 (Saito et al. – U.S. Patent App. No. 2004/0207962 A1) in view of Hasegawa (JP '309 A) and Kishi et al. (JP 2000-163717 A). This is a provisional obviousness-type double patenting rejection.

Regarding claims 1 and 17 - 30, Saito et al. ('962 A1) disclose the claimed limitations much in the same manner that Hasegawa et al. ('389 A1) did above, also relying upon Hasegawa ('309 A) to provide motivation for a magnetization control layer for controlling the magnetization of the free magnetic layer.

Neither Saito et al. nor Hasegawa ('309 A) disclose a first AFM layer having a space in the track width direction and an electric resistance in the space changing in relation to a magnetization direction of the free magnetic layer and a magnetization direction of the second magnetic layer.

However, Kishi et al. teach a first AFM layer with a predetermined space in the track width direction meeting applicants' claimed limitations inorder to control the lead gap and overall magnetoresistive characteristics of the sensor. Given the similarity in both structure and composition of the first AFM layer and the predetermined space (i.e. a thinned portion of said first AFM layer), the Examiner deems there is sound basis that such a structure would necessarily exhibit an electric resistance meeting applicants' claimed functional limitations.

It would, therefore, have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Saito et al. in view of Hasegawa (JP '309 A) to utilize a first AFM layer meeting applicants' claimed structural limitations as taught by Kishi et al. since such a structure can control the lead gap and overall magnetoresistive characteristics of the sensor.

Regarding claims 2, 4 and 15, JP '309 provides evidence that bias means meeting applicants' claimed material and structural limitations are known bias means as argued above with respect to the rejection predicated on the Hasegawa et al. ('389 A1) reference. Claims 4 and 15 are deemed met for substantially identical reasons as put forth above with respect to the rejection predicated on the Hasegawa et al. ('389 A1) reference.

Regarding claims 3 and 5 - 14, JP '309 provides evidence that bias means meeting applicants' claimed material and structural limitations are known bias means as argued above with respect to the rejection predicated on the Hasegawa et al. ('389 A1) reference. The additional limitations in these claims are deemed met for substantially identical reasons as put forth above with respect to the rejection predicated on the Hasegawa et al. ('389 A1) reference.

Regarding claims 16 and 31, Hasegawa (JP '309 A) teach the claimed structure, functional and material limitations as put forth above with respect to the rejection predicated on the Hasegawa et al. ('389 A1) reference.

8. Claims 1 - 31 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 – 17 and 40 - 62 of copending Application No. 10/925,268 (Hasegawa et al. – U.S. Patent App. No. 2005/0018363 A1) in view of Hasegawa (JP '309 A) and Kishi et al. (JP 2000-163717 A). This is a provisional obviousness-type double patenting rejection.

Regarding claims 1, 3, 5 – 14 and 16 - 31, Hasegawa et al. ('363 A1) disclose the claimed limitations much in the same manner that Hasegawa et al. ('389 A1) did above, also relying upon Hasegawa ('309 A) to provide motivation for a magnetization control layer for controlling the magnetization of the free magnetic layer.

Neither Hasegawa et al. ('363) nor Hasegawa ('309 A) disclose a first AFM layer having a space in the track width direction.

However, Kishi et al. teach a first AFM layer with a predetermined space in the track width direction meeting applicants' claimed limitations inorder to control the lead gap and overall magnetoresistive characteristics of the sensor.

It would, therefore, have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Hasegawa et al. ('363) in view of Hasegawa (JP '309 A) to utilize a first AFM layer meeting applicants' claimed structural limitations as taught by Kishi et al. since such a structure can control the lead gap and overall magnetoresistive characteristics of the sensor.

Regarding claims 2, 4 and 15, JP '309 provides evidence that bias means meeting applicants' claimed material and structural limitations are known bias means as argued above with respect to the rejection predicated on the Hasegawa et al. ('389 A1)

reference. The Examiner notes that regarding claim 15, Hasegawa et al. ('363) explicitly disclose track widths meeting applicants' claimed limitations (*claim 62*). Claim 4 is deemed met for substantially identical reasons as put forth above with respect to the rejection predicated on the Hasegawa et al. ('389 A1) reference.

Regarding claims 3 and 5 - 14, JP '309 provides evidence that bias means meeting applicants' claimed material and structural limitations are known bias means as argued above with respect to the rejection predicated on the Hasegawa et al. ('389 A1) reference. The additional limitations in these claims are deemed met for substantially identical reasons as put forth above with respect to the rejection predicated on the Hasegawa et al. ('389 A1) reference.

Regarding claims 16 and 31, Hasegawa (JP '309 A) teach the claimed structure, functional and material limitations as put forth above with respect to the rejection predicated on the Hasegawa et al. ('389 A1) reference.

9. Claims 1, 3, 5 – 10, 13, 14 and 16 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 14 and 15 of U.S. Patent No. 6,608,740 B2 (Tanaka et al.) in view of Kishi et al. (JP '717 A).

Regarding claims 1, 3, 5 – 14 and 16, Tanaka et al. disclose the claimed limitations much in the same manner that Hasegawa et al. ('389 A1) did above, though Tanaka et al. disclose a magnetization control layer for controlling magnetization of the free magnetic layer (*claim 1*).

Tanaka et al. fail to disclose a first AFM layer having a space in the track width direction nor an electric resistance functioning as claimed by applicants.

However, Kishi et al. teach a first AFM layer with a predetermined space in the track width direction meeting applicants' claimed limitations inorder to control the lead gap and overall magnetoresistive characteristics of the sensor. Given the similarity in both structure and composition of the first AFM layer and the predetermined space (i.e. a thinned portion of said first AFM layer), the Examiner deems there is sound basis that such a structure would necessarily exhibit an electric resistance meeting applicants' claimed functional limitations.

It would, therefore, have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Tanaka et al. to utilize a first AFM layer meeting applicants' claimed structural limitations as taught by Kishi et al. since such a structure can control the lead gap and overall magnetoresistive characteristics of the sensor.

Regarding claims 3, 5 – 10, 13, 14 and 16, the Examiner notes the disclosure of Tanaka et al. teach(es) that the claimed bias means (i.e. permanent magnet layers) and structural limitations are obvious variations of the disclosed invention (*Figures and description of examples/embodiments*). Applicants are reminded that while it is generally prohibited from using the disclosure of a potentially conflicting patent or application in an Double Patenting analysis, there are two exceptions permitted by the MPEP. Specifically, "those portions of the specification which provide support for the patent claims may also be examined and considered when addressing the issue of

whether a claim in the application defines an obvious variation of an invention claimed in the patent". In the instant case, since the layers are claimed in Tanaka et al., the subject matter describing what materials are used for the layers, as well as their relative structural locations are all deemed supporting subject matter, and hence is appropriate for relying upon in a double patenting situation.

10. Claims 2, 4, 11, 12 and 15 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 14 and 15 of U.S. Patent No. 6,608,740 B2 (Tanaka et al.) in view of Kishi et al. (JP 717 A) as applied above, and further in view of Mack et al. (U.S. Patent No. 6,462,919 B1).

Tanaka et al. and Kishi et al. are relied upon as described above.

Neither of the above disclose a magnetization control layer meeting applicants' claimed material and structural limitations.

Regarding claims 2, 4, 11 and 12, Mack et al. teach that providing exchange tab structures comprising a 2nd AFM material meeting applicants' claimed structural limitations are equivalent bias means for the free magnetic layer and results in improved exchange coupling with the free magnetic layer (*Figures 6A and 6B and col. 8, line 34 bridging col. 9, line 12*).

It would, therefore, have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Tanaka et al. in view of Kishi et al. to utilize a magnetization control layer meeting applicants' claimed limitations as taught by Mack et al. since such a structure is a known equivalent biasing means to

permanent magnetic layers and results in improved exchange coupling with the free magnetic layer.

Regarding claim 15, the Examiner notes that it is known in the art that the smaller the track width, the smaller the domain size a MR sensor can read/write to. Hence, the Examiner deems it would have been obvious to optimize the track width to within applicants' claimed range since such a range would allow increased read/write density.

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

12. Claims 1, 5 – 10, 13, 14 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al. (U.S. Patent App. No. 2001/0014000 A1) in view of Kishi et al. (JP '717 A).

Regarding claims 1, 9 and 10, Tanaka et al. disclose a magnetic detecting element comprising a multilayer film comprising a first antiferromagnetic (AFM) layer (*Figure 5, element 11*), a pinned magnetic layer (*elements 12A – 12C)*, a nonmagnetic material layer (*element 13*) and a free magnetic layer (*element 14*), which are laminated in that order on a substrate (*element 10a*), and a magnetization control layer for controlling magnetization of the free magnetic layer (*elements 17*), wherein the pinned magnetic layer comprises a first magnetic layer extending in a track width direction in

contact with the first AFM layer, a second magnetic layer facing the first magnetic layer in a thickness direction, and a nonmagnetic intermediate layer interposed between the first and second magnetic layers, magnetization of the first and second magnetic layers being antiparallel to each other (*elements 12A – 12C*). Regarding the language in claim 10, the Examiner notes that applicants' "substrate" is not limited to a single layer, so simply by virtue of the fact that the 1st AFM layer has a space in the track width direction, the "substrate" must have a recess corresponding to the 1st AFM layer (*see Kishi et al., Figure 5, though the Examiner acknowledges that the lower portions are the free layer with the exchange tab biasing elements, but the Examiner notes that "substrate" elements 13, 14 and 28 necessarily form recesses where elements 30 are located*).

Tanaka et al. fail to disclose a first AFM layer having a space in the track width direction nor an electric resistance functioning as claimed by applicants.

However, Kishi et al. teach a first AFM layer with a predetermined space in the track width direction meeting applicants' claimed limitations inorder to control the lead gap and overall magnetoresistive characteristics of the sensor. Given the similarity in both structure and composition of the first AFM layer and the predetermined space (i.e. a thinned portion of said first AFM layer), the Examiner deems there is sound basis that such a structure would necessarily exhibit an electric resistance meeting applicants' claimed functional limitations.

It would, therefore, have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Tanaka et al. to utilize a first

AFM layer meeting applicants' claimed structural limitations as taught by Kishi et al. since such a structure can control the lead gap and overall magnetoresistive characteristics of the sensor.

Regarding claims 5 - 7, Tanaka et al. disclose the claimed layer structure (*Figure 2*).

Regarding claim 8, the Examiner deems that it would have been obvious to one of ordinary skill in the art to make the space in the first AFM layer approximately equal to the track width since the track width would then possess a more uniform structure and/or properties, especially given the showing in Figure 5 of the Kishi et al. invention.

Regarding claims 13 and 14, while Tanaka et al. fail to explicitly disclose an embodiment wherein the bottoms of the permanent-magnet layers are position above at least the pinned magnetic layer, the Examiner notes that since the bias layers are designed solely to affect the biasing of the free magnetic layer, it would have been obvious to one of ordinary skill in the art to raise or lower the "bottom" of the biasing element to any position below the free magnetic layer, provided that the biasing element maintains it's contact with the free magnetic layer. I.e. such a structure as claimed in claim 13 is deemed a functional equivalent to the disclosed structure and merely a matter of choosing whether to deposit more of the underlayer material or more of the biasing material.

Regarding claim 16, Tanaka et al. disclose electrodes meeting applicants' claimed limitations (*Figure 5, elements 18*).

13. Claims 2 - 4, 11, 12 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al. in view of Kishi et al. as applied above, and further in view of Hasegawa (JP '309).

Tanaka et al. and Kishi et al. are relied upon as described above.

Regarding claims 2, 4, 11 and 12, neither Tanaka et al. nor Kishi et al. disclose bias layers comprising a second antiferromagnetic layer meeting applicants' claimed structural limitations.

However, the Examiner notes that biasing means meeting applicants' claimed limitations (*JP '309 – Figure 13, elements 26*) are known equivalent biasing means to using permanent magnetic layers as disclosed by Tanaka et al. (*Tanaka et al.: element 17 and Paragraphs 0257; and JP '309 – Figure 12, elements 29*). It would therefore have been obvious to use second AFM layers meeting applicants' claimed limitations since such a structure is a functional equivalent structure to the permanent magnet biasing means utilized in the Tanaka et al. invention.

Regarding claim 3, Tanaka et al. disclose permanent magnetic layers (*elements 17 and Paragraph 0257*) in contact with both side portions of the free layer. While Tanaka et al. utilizes underlayers between the permanent magnetic layers and the free layer, the JP '309 provides evidence that such layers are not required and that permanent magnets can be used to bias the free magnetic layer by being in direct contact with the free magnetic layer (*JP '309: Figure 12, elements 29*).

Regarding claim 15, the Examiner notes that it is known in the art that the smaller the track width, the smaller the domain size a MR sensor can read/write to. Hence, the

Examiner deems it would have been obvious to optimize the track width to within applicants' claimed range since such a range would allow increased read/write density.

14. Claims 17, 18, 20, 21 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al. in view of Kishi et al. as applied above, and further in view of Lin (U.S. Patent No. 5,949,623).

Tanaka et al. and Kishi et al. are relied upon as described above.

Regarding claim 17, neither of the above disclose a nonmagnetic metal layer meeting applicants' claimed material and structural limitations.

However, Lin teaches that when forming an AFM layer comprising a reduced thickness middle portion located over the track width, reducing the thickness sufficiently can produce a non-magnetic material meeting applicants' claimed material and structural limitations, thereby resulting in more precisely aligned side edges (*col. 1, lines 34 – 52; col. 3, line 66 bridging col. 4, line 3; col. 5, lines 29 – 59; and col. 6, lines 13 – 37*). While Lin is directed to an AFM bias layer above a free layer, the Examiner notes that the art is analogous and since Kishi et al. already provides the motivation to thin the AFM layer above the pinned magnetic layer, Lin would be within the knowledge of one of ordinary skill in the art when turning to desired thickness values for the predetermined space. Finally, while Lin does not explicitly state that the layer forms a disordered crystal structure, the Examiner deems that such a structure is, at least in part, responsible for the observation of a loss of antiferromagnetic property, and hence would

necessarily result from the reduced thickness of the AFM material in the predetermined space.

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Tanaka et al. in view of Kishi et al. to utilize a nonmagnetic metal layer meeting applicants' claimed limitations as taught by Lin, since such a layer can be used to produce more precisely aligned side edges for the AFM layer.

Regarding claims 18 and 21, the limitation(s) "epitaxial" and "heteroepitaxial" in claim 18, have given the term(s) the broadest reasonable interpretation(s) consistent with the written description in applicants' specification as it would be interpreted by one of ordinary skill in the art. *In re Morris*, 127 F.3d 1048, 1054-55, 44 USPQ2d 1023, 1027 (Fed. Cir. 1997); *In re Donaldson Co., Inc.*, 16 F.3d 1190, 1192-95, 29 USPQ2d 1845, 1848-50 (Fed. Cir. 1994). See MPEP 2111. Specifically, any layer deposited on an adjacent layer is deemed to meet the limitations "epitaxial" and "heteroepitaxial", since the broadest reasonable definition of "epitaxial" as it would be interpreted by one of ordinary skill in the art is "directly on". Furthermore, Tanaka et al. disclose AFM materials meeting applicants' claimed composition limitations (*Paragraph 0206*).

Regarding claim 20, Kishi et al. disclose reducing the AFM layer to thickness values meeting applicants' claimed range (*Paragraph 0032 of Machine Translation*), as does Lin for reducing the AFM material to a non-magnetic material in the predetermined space (*col. 6, lines 21 – 33*).

Regarding claim 31, Tanaka et al. disclose electrodes meeting applicants' claimed materials and structural limitations (*Paragraph 0259*).

15. Claims 22 – 25 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al. in view of Kishi et al. and Lin as applied above, and further in view of Freitag et al. (U.S. Patent App. No. 2003/0179516 A1) and Tanahashi et al. (U.S. Patent App. No. 2005/0042479 A1).

Tanaka et al., Kishi et al. and Lin are relied upon as described above.

Regarding claims 22 – 25, none of the above disclose first magnetic layers meeting applicants' claimed lattice structure and/or composition limitations.

However, Freitag et al. teach a sensor comprising a pinned magnetic layer comprising a first and second magnetic layer, wherein one of the layers comprises a CoFe alloy meeting the claimed composition limitations in claim 23 and one of the layers comprises a CoFe alloy meeting the claimed composition limitations in claim 25 (*Figures and Paragraphs 0011 – 0012*). Furthermore, Freitag et al. disclose inverting these compositions so that, effectively, the "first magnetic layer" can comprise either composition (*ibid and entire disclosure*). Freitag et al. teach that such a structure results in improved self-pinning and improved magnetoresistance coefficient (*Paragraphs 0011 – 0013*).

Freitag et al. does not explicitly disclose whether the $Co_{90}Fe_{10}$ alloy possesses a fcc lattice structure meeting applicants' claimed limitations, or whether the $Co_{60}Fe_{40}$ alloy possesses a bcc lattice structure meeting applicants' claimed limitations.

However, the Examiner takes the position that since Freitag et al. does not disclose any unique or special processing conditions that one of ordinary skill in the art would readily appreciate that these alloy compositions are implicitly taught to be the natural lattice structure based on the standard sputtering techniques disclosed by Freitag et al. (*Paragraph 0047*), which the Examiner deems are the claimed lattice structures (*see Tanahashi et al., Figure 9*).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Tanaka et al. in view of Kishi et al. to utilize first magnetic layers meeting applicants' claimed limitations as taught by Freitag et al. and Tanahashi et al. since such layers result in improved self-pinning and an improved magnetoresistance coefficient.

Regarding claim 30, Freitag et al. disclose utilizing embodiments possessing a positive magnetostrictive coefficient (*examples*).

Conclusion

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin M Bernatz whose telephone number is (571) 272-1505. The examiner can normally be reached on M-F, 9:00 AM - 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carol Chaney can be reached on (571) 272-1284. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KMB
April 29, 2005

Kevin M. Bernatz, PhD
Primary Examiner